

*Denison (6)*  
*Paul F. Munde M.D.*  
**REPORT**

ON

**THE CLIMATE OF COLORADO,**

AND

**ITS RELATION TO PULMONARY DISEASES.**

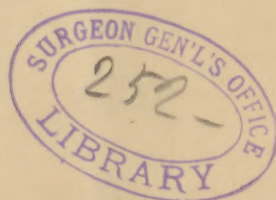
*Regards C.D.*

BY ✓

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## REPORT.

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IN attempting a report of the kind I have the honor herewith to present, it is well to explain that the field for study is large, and the trail of investigation obstructed by many difficulties. On the one hand, there is the lack of complete meteorological records, with generally various understandings (or misunderstandings) of pathological facts by professional men. On the other hand, the comparatively recent development of this section of country, and the scarcity of statistics of carefully-recorded cases, combine to restrain the faithful reporter in undertaking so difficult a task.

But with the facts, and both personal and professional experience at hand, I hope to prove conscientious and impartial in the performance of this duty, even though it lacks the completeness attending more extended research.

### THE CLIMATE.

To adapt the means—the *climate of Colorado*—to the end—the *relief or cure of Pulmonary Diseases*—a somewhat minute description of what constitutes the climate of the Centennial State is necessary. We must consider all the conditions which make up the weather and atmosphere of this section.

### TOPOGRAPHY.

Colorado, situated between the 102d and 109th degree of longitude west from Greenwich, and between the 37th and 41st degree of north latitude, covers an area of 105,000 square miles, being larger than the five middle States, or nearly as large as

New England and New York, and has an average elevation of more than 6000 feet above sea level. That portion of the Territory traversed by the Rocky Mountain Range, together with the unsettled country west of the Range, it is not my purpose to refer to in this report. The plains and foothills east of the mountains, however, furnish a remarkable similarity in climatic attributes, and a sufficient field for a report of this kind. It is this section of Colorado, lying between the elevations of four and eight thousand feet above sea-level, to which I wish to be considered as herein referring, unless other localities are specified.

This belt of land running north and south through Colorado, varies in altitude chiefly with the location of its few rivers. The Divide, a low ridge separating the waters of the South Platte on the north, and the Arkansas on the south, is between two and three thousand feet higher. These rivers and their branches come down from the mountains, and the elevated parks to the west, through rugged gorges or cañons, and have for ages been depositing their washings which form the plains below. The region specified is remarkable for the absence of trees, except on the Divide, among the foothills and along the streams; also for the growth of a short, fine quality of grass which covers the plains and cures as it grows.

The sandy soil, impregnated more or less with alkali, favors radiation of heat and absorption of moisture, and to a certain extent influences the marked meteorological effects which are noticeable.

#### .TEMPERATURE.

The climate of this region is not equable except as compared with others of similar elevation. Generally speaking, equability decreases as altitude increases. The rarity of the air favors a rapid change of temperature.

The diurnal and annual variations are considerable, the elevation and exposure of localities having more to do with temperature than their latitude. Excepting differences due to these reasons, the isothermal lines run nearly north and south through the State. For instance, according to the report of the Chief Signal Officer for 1865, Cheyenne, in Wyoming Territory, at an elevation of about 6000 feet, has an annual mean temperature of  $43^{\circ}.6$ ; Den-



ver, at 5200 feet elevation,  $49^{\circ}.2$ ; Colorado Springs, at 6000 feet,  $46^{\circ}.8$ ; Sante Fé, New Mexico, at 6800,  $49^{\circ}.2$ . The last is the same as the annual mean of Denver, while the difference in altitude between Denver and Santa Fé, 1500 feet, is about equivalent to five degrees of temperature; the difference between the same four degrees of latitude on the Atlantic coast being ten degrees, according to Prof. Henry's Temperature Chart of the United States. Generally speaking, the average temperatures of different localities in this region are a few degrees lower than those of places of the same latitude on the Atlantic coast, yet not nearly as much lower as might be expected, judging by the rule of *one degree lower temperature for each 300 feet rise in elevation*. Besides, the abundance and intensity of the sunshine, furnishing diurnal radiation, give the impression to all of a relatively higher temperature than the records show, which are taken in the shade.

In getting the mean daily temperature in winter, the night observations, when people are mostly indoors, affect the very favorable day observations, when being outdoors is chiefly attractive.<sup>1</sup>

The dryness and rarity of the air are generally felt to lessen the severity of sudden changes or extremes.

So, as to temperature, this climate compares quite favorably with eastern places of the same latitude, especially for those persons who are much out of doors, and subjected, in an atmosphere of remarkable diathermancy, to the direct rays of the sun.

#### RAIN-FALL AND RELATIVE HUMIDITY.

The annual rain-fall varies from eight to twenty inches, the least fall being in the valleys, and the greatest on the Divide and foothills. From October to April this moisture generally comes in the form of a light snow, which melts as it falls or soon after. There is not much regularity in the storms of this section, except the daily afternoon showers in July, or about that season, while storms are quite infrequent during the fall and winter months.

The low ratio of relative humidity is remarkable, while the *absolute* humidity is still less than the *relative*. For, as the capa-

<sup>1</sup> The 9 P. M. record is doubled to get the average temperature according to the rules governing the Signal Service Bureau:

city of air to hold moisture is governed by its temperature which is changed by rarefaction, and as the pressure to the square inch is a fifth less at an elevation of 6000 feet than at sea-level, therefore air at the foot of the mountains has less absolute moisture than at sea-level. But the air seldom reaches saturation here, and sometimes during long storms from upper strata of clouds, the degree of saturation is between seventy and eighty per cent., the annual average being about forty-six. This condition, the diathermancy of the air, and increased radiation of heat acquired directly from the sun, favor rapid evaporation and diffusion of moisture. This is exemplified by the fact that the signal service observer has to fill the cup of his wet bulb thermometer twice a day at Denver, while at some stations east it is done but once in two days. According to records kept by these observers at Denver for '73, '74, and '75, there have been but eleven days in that time during which the sun has been wholly obscured by clouds.

There are no regular fogs or night dews here. The *dew point*, around which the temperature at night hovers, and is controlled in moister climes, is almost never reached, the colder temperature at night being attributable not to evaporation, but the withdrawal of the sun's influence.

With these facts in view, I think I am warranted in saying that the 46 per cent. "relative humidity," the mean for a year in Denver, indicates not half the *absolute moisture* existing on the Atlantic and Pacific coasts, and in the valleys of eastern rivers, where the mean relative humidity reaches 70 to 80 per cent. This section of Colorado is probably dry enough for comfort, whether a still smaller ratio of moisture would be preferable for some invalids remains to be proven, in view of special classes of cases to be treated.

#### WINDS.

The mountains to the west undoubtedly have a salutary influence on this climate, especially as affecting the character of the winds. This is shown by the signal service charts, giving the wind directions which are most and least likely to be followed by rain.

In the following table I have averaged these records for the whole year for stations in this vicinity.



	Winds most likely to be followed by rain.			Winds least likely to be followed by rain.		
Cheyenne,	N. E.	E.	S. E.	S.	S. W.	W.
Denver,	N.	N. E.	E.	S.	S. W.	W.
Pike's Peak,	S.	S. W.	W.	N.	N. E.	E.
Sante Fé,	S. E.	S.	S. W.	N. W.	N.	N. E.

This table is very significant, for it will be observed that the winds, viz., the south, southwest, and west, which bring storms on Pike's Peak, are the very ones which harbingers pleasant weather for Denver, Cheyenne, and northwestern Colorado. The mountains have acted as condensers and deprived them of their moisture. It is not an unfrequent occurrence to see storm clouds hovering around the lofty mountain peaks to the west, or as it were ineffectually endeavoring to spread out toward the east, while quiet and sunshine rule over the plains below, the storm being held by the mountains or opposed by eastern currents. Then again the moist winds from the Gulf of Mexico condensed as they are cooled by rising, and as they meet the Rocky Mountain range, give up their moisture in eastern New Mexico, are turned to the north, and come to us bringing pleasant weather. The north returns the compliments of the south, for the north, northeast, and east winds, coming up from the valley of the Missouri River, bring most of the storms for northeastern Colorado, and thus sweated of their rain push on to Mexico, or rising above the southern current, give their moisture to the plains, and pleasant weather to the southwestern mountains.

The winds of Colorado are fitful, and if rapid are on the plains of short duration. It is to be remarked that the force of winds, the rapidity being the same, is much lessened by reason of the lightness of the air. Sometimes preceding a storm, or accompanying some atmospheric disturbance, the wind swoops down as it were from aloft, or comes in a cloud of dust and sand, especially when the hard-baked soil is loosened by travel. These dust storms give an unfavorable impression of the climate. The inconsiderable force and the infrequency of these marked disturbances may be inferred from a table of winds in the annual report of the Chief Signal officer, which gives us interesting statistics, showing the infrequency of winds in general. Take the winds of winter: since for the rest of the year they are noticed as blowing quite evenly as to direction, except the south wind, which generally blows more frequently than the others, and the north

wind in spring and autumn twice as often in Colorado Springs as in Denver. Of the eighty-one signal stations where the full 270 observations (*i. e.* three daily) were reported for the winter of 1874, the observations denominated "calm" were 58 at Denver and 71 at Colorado Springs; the latter being the seventh, and the former the ninth highest. At only two stations, Burlington, Vt., and Portland, Oregon, were the south wind observations in excess of those at Denver, namely 76 out of the 270. As these south winds are usually soft breezes from the Gulf of Mexico, deflected to the north and passing under the high belt of west winds, which come over the Rocky Mountains, a large proportion of pleasant weather is thereby explained.

Cheyenne, just over Colorado's northern border, is less protected by the Rocky Mountains than points south, since nearly half of the winter winds are recorded as from the west. But Cheyenne was more favorably circumstanced as to the infrequency of the disagreeable north, northeast, and northwest winds than any place except Virginia City, Montana, while Denver had less of these winds than 66 out of the 81 stations. As to the total amount of wind on the plains, there is an interesting chart in the statistical atlas of the last census of the United States, which gives, in a pictorial way, "the total movements of the air with resultants" for the year ending with May, 1873. There are sixty-two signal service stations represented in this chart, including three in this vicinity, *i. e.*, Cheyenne, Denver, and Santa Fé. Reckoning in order, from the least to the greatest total movement of air at all these stations, Denver is found to be about the tenth, Santa Fé the sixteenth, and Cheyenne the forty-sixth.

It can be concluded, then, that along the eastern base of the Rocky Mountains it is not very windy, either as to the number of winds observed, or the total movement of the air, those winds generally prevailing which bring pleasant weather.

#### ATMOSPHERIC ELECTRICITY.

The climate of this elevated region is pre-eminently *stimulating*. That this quality is chiefly due to the increased amount of atmospheric electricity I have no doubt. As we rise in altitude the electric dose increases, and some organizations are perceptibly influenced thereby; some to their injury and others with



apparent benefit, so far as their feelings are concerned. The medicinal effects of this element which surrounds us is a subject which, while extremely fascinating and giving promise of valuable information in return for labors devoted to it, is fraught with many difficulties, because of the very nature of the element itself.

Scientists tell us that the "atmosphere always contains free electricity, which is almost invariably positive." Alexander Buchan says that of 10,500 observations at Kew Observatory, 10,176 were positive and 364 negative. When the sky is cloudless the electricity is positive, the intensity increasing with the height. Among other experiments, that of Becquerel and Breschet of shooting an arrow, attached by a delicate conductor to an electrometer, vertically into the air, proved conclusively the increased electric tension at a height of 250 feet. If even a less proportionate increase exists for altitudes of four to eight thousand feet, then the large amount of atmospheric electricity at the base of the Rocky Mountains is explained. Instances of parties receiving shocks when passing over eminences in the mountains are not uncommon, and of force enough to cause a lengthened disturbance of the equanimity of the nervous system; as one explorer said to me, "to make one's hair stand on end."

Whether the electricity of high altitudes exists in an inverse ratio to that of oxygen, and whether or not we breathe electricity as we do oxygen, as suggested by the late venerable Dr. George O. Jarvis, of Portland, Conn., are intricate questions which are yet to be solved, when science teaches more of this subtle agent than at present.

But if we do breathe atmospheric electricity, then aside from the increase due to this altitude, we inhale a fifth more of it at about 6000 feet elevation than we would at sea level, to get the same amount of oxygen. This is based on the fact that there is a difference of one-fifth in weight in a specified volume of air, which is due to the difference between sea level and the altitude of 6000 feet. Whether living on this atmospheric stimulant we have to take less in weight of oxygen to get along in life is another intricate question which I have not space here to discuss, even if I were able.

## OZONE.

Our surmises<sup>1</sup> as to the existence of a large proportion of ozone in this region are destined to be verified. The almost total absence of swampy land, and the small amount of decaying or putrefying material to use up ozone, would explain an expected excess on most of the Rocky Mountain slope.

My observations in the centre of Denver last winter were uncertain and unreliable till, by the aid of Prof. Kedzie, of Michigan, I learned that the sulphurous fumes from the soft coal we burn neutralized this agent. I am further of the opinion that the extreme dryness of the air in Colorado in a measure vitiates the results of Schonbein's starch and iodide of potassium test used.<sup>2</sup>

## THE SEASONS.

While the variations of temperature from summer to winter, probably also of atmospheric electricity and ozone, considerably influence the effect of this climate on pulmonary diseases, especially as increasing the effect of altitude in cold weather, yet for many of these invalids our winter climate is paradisaical compared with that of cities and towns along the northern lakes and rivers above Mason and Dixon's line, with their chilling winds and saturated atmosphere.

As the growing idea becomes more universal of a stimulating and tonic climate for those chronic lung diseases of which there is any hope, Colorado will be better known as a *winter home* for invalids.

While exceptional storms and cold snaps must be expected, the average winter of Colorado is a blessing, inviting to almost daily rides and walks all those *who are able to be out of doors*, and no others (asthmatics excepted) should be urged to come to Colo-

<sup>1</sup> "The Influence of the Climate of Colorado on the Nervous System," *Archives of Electrology and Neurology* for November, 1874.

<sup>2</sup> Since then a sufficient number of careful observations have been taken by friends in the suburbs of Denver, on the Divide, and in the mountains, to show that the records of ozone in Colorado will compare favorably with those, the only ones I have for comparison, taken at the Agricultural College of Michigan by Prof. R. C. Kedzie, and at St. Paul, Minn., by the signal service observer, J. A. Barwick, now of the Denver Signal Station.

rado, as *indoor* life has no special advantages. The winter which has just passed has surpassed my expectations in this life in continuous genial sunny days and absence of disturbing elements.

Winter weather is quite as likely to come in spring as before it. But between occasional snow and dust storms, sample Colorado weather is *sandwiched* all through spring. In summer the days are warm, though somewhat relieved by the July showers and gentle breezes, while the nights are generally refreshingly cool.

In summer and early autumn the mountains are enticing to almost every one, for a more exhilarating and delightful atmosphere than the plains afford. I think autumn is the best, the most evenly sunny season of them all.

### SCENERY.

A long report could be written on the scenery of Colorado alone. Aside from a lack of space, I must confess myself unable to do the subject justice at the present time. It is noteworthy, however, that the Rocky Mountains with their parks and cañons offer valuable adjuncts to Colorado's treasures of climate; enticing the invalid tourist to restorative hardships which, without these pleasurable incentives, would never be undertaken. That the mind can forget the bodily ills, with which it has long been harassed, is a blessing which comes with the rapture and sublimity excited by Nature's wonders in Colorado. Such are the "Grand Cañon of the Arkansas;" "The Garden of the Gods;" the rugged gorges through the mountains; the lofty mountain peaks towering like "Ossa on Pelion piled" above the lesser heights, giving variegated and extensive views of the surrounding country; the ever-varying grandeur of the foothills, mountains and snow-capped peaks as seen from the plains, now shaded by clouds, tinted with snow, or differently changed by the seasons; the beautiful sunsets, which in autumn reach a climax of magnificence long to be remembered by the fortunate beholder.

### PULMONARY DISEASES.

As an apology for devoting so much space to the description of Colorado's climate, I wish to aver that the subject covers too much ground to be minutely and comprehensively treated in a



report of this character. This will explain the absence of many illustrations, and explanatory tables which would make the report plainer to all.

But a somewhat extended description of the climate is necessary. For if physicians are to take the responsibility of sending their patients to the Eastern Rocky Mountain Slope, they will for the most part reason the matter out themselves, knowing the basis of benefits to be expected. So if any differ with me as to the following conclusions, they have the preceding *data*, which they can rely upon in deciding whether to recommend their patients to journey to Colorado.

The clinical results are such as might be expected under these existing conditions, and the organs of respiration are those chiefly influenced.

The therapeutic efficacy of this rarefied atmosphere in lung diseases, springs from a healthy respiratory activity which is opposed to the theory of *rest*, the paramount idea in the treatment of many other ills. This may be regarded as respiratory gymnastics, its gauge being the lessened atmospheric pressure, which is about twelve pounds to the square inch at 6000 feet above the sea. I will briefly illustrate this effect as it varies in different pulmonary diseases, commencing with that one which is most decidedly benefited.

### ASTHMA.

Of all the remedies which have been recommended in the treatment of this troublesome malady, I know of none which can compare with the light air of this inland region. I speak thus highly of our prescription, feeling that, almost without exception, uncomplicated cases of asthma may gain decided relief or a permanent cure in Colorado. And, as to complications, the relief of the asthma often more than counterbalances the unfavorable effects of elevation in cardiac lesions, cavities in phthisis, and marked emphysema.<sup>1</sup>

The mistaking emphysema for asthma, and the advanced age

<sup>1</sup> An asthmatic patient I have in mind, with enlargement of the heart, mainly from dilatation of the left ventricle, with aortic insufficiency, has twice by advice, on account of the heart disease, gone down from this elevation, but with such poor relief of his general symptoms, that he was contented to return to remain in Denver.

of some who have had asthma many years, with perhaps the lung tissue seriously involved, will sometimes, I think, explain the only slight benefit received. Generally speaking, the relief is marked as the base of the mountains is reached, and often after crossing the Missouri River. If all the results were written, hundreds of the present residents of Colorado could be cited who had asthma months or years before coming here, who had exhausted all the other known means of relief in vain, but who have now been nearly or quite free from asthmatic symptoms since becoming residents of Colorado.

I will mention only two or three instances by way of illustration. A lady from Vermont, of marked nervous temperament, perhaps from long suffering; twenty-four years old and an asthmatic since childhood; had tried almost every means of relief. From the age of fourteen, till she came to Colorado nearly a year ago, she had been but three or four days in each month free from asthma, the exacerbations of the paroxysms being coincident with the catamenia. After marriage she was advised to bear children with hopes of relief; but two months after becoming *envelope*, the asthma had so greatly increased that she "had to come to Colorado." Since then she has been almost entirely free from dyspnoea, she is the picture of health, and happy to make her future home under the shadow of the Rocky Mountains.

Mr. F. J. B. Crane, of Denver, who has shown much interest in his fellow sufferers, was chairman of a committee, representing a convention of asthmatics held in 1873. They collected the histories of 120, some of them exceedingly obstinate cases, all of whom were evidently cured or much relieved in Colorado. Mr. Crane was from Detroit, Michigan. "Had asthma for more than thirty years, and badly for fifteen; for over ten years had been disturbed every night; travelled in most of the United States and abroad without benefit; arrived in Denver in March, 1871; after three weeks, was surprised one morning to find he had slept all night;" this he did every night after that while he remained; went to Detroit, the disease returning after a short time, and that winter he suffered more than ever before; returned to Colorado in April, 1872, and the asthma left him after two weeks and did not trouble him again until the next year, when again going east for a short visit, he was attacked with dyspnoea while crossing the Missouri River at Omaha.

The plains at the foot of the mountains are not high enough for some asthmatics, who may find relief by going to the Divide or some of the mountain towns. A permanent residence here is in most cases necessary.

What is the rationale of this marked effect?

While the increased amount of atmospheric electricity, the dryness and purity of the air may be important auxiliaries, I am of the opinion that it is due to the *mechanical influence* of lessened atmospheric pressure. The *modus operandi* seems to be as follows: Asthma being defined a *paroxysmal contraction of the circular muscular fibres of the smaller bronchial tubes*; the muscles concerned in expiration are in a condition for normal activity when the thorax is distended, while the muscles producing inspiration seem to be more intimately associated than the others with the constricted fibres of the bronchial tubes. Inspiration then, as compared with expiration, is especially difficult because of this constriction. Now lessen the density of the air breathed, and the lungs must labor with more air to get the same amount of oxygen as before, sufficient to sustain life. The increased respiratory labor, compressing the air, gives a proportionately greater pressure on the inside of the lungs than before, compared with that of the surrounding atmosphere.

Thus augmented within, outward force distends the constricted circular muscles of the bronchial tubes to a point where they lose their spasm. Their contraction is simply no longer possible; as with the hand we can lift a ball which the fingers can grasp, but if the ball is simply increased in size, a point is reached when the fingers lose their power and it is dropped. In such a way, I conceive, the expansion of the smaller bronchi is produced by the outward pressure of the air within them. A lady, an asthmatic from Pennsylvania, while climbing the mountains with some friends, was so troubled with dyspnoea that, coming to a large rock, she declared (woman-like) she could never reach the top. In response to the urging of her friends she made the effort, expecting to await their return on the top of the rock. But after a short rest she found the difficulty of breathing had gone, and she ran with ease to catch up with them. What was it which so suddenly opened the bronchial passages to the free admission of air, if not this mechanical effect of the rarefied atmosphere?



## EMPHYSEMA.

I hardly know what to say about emphysema, so few uncomplicated cases come to Colorado. I closely watched a patient in one case, and was surprised at his improvement, but his lungs were otherwise defective, and he came from the miserable climate of Chicago. The emphysema may have been secondary to a broncho-pneumonia, which the climate here benefited. I believe simple emphysema will be aggravated by this and higher elevations.

## PREVENTION OF PHTHISIS.

I need only refer the discriminating mind to the first part of this report for evidence that there is prolongation of life, health, and happiness in Colorado, for thousands of those who are destined by inheritance or acquired tendency to die of consumption where they now live. The increased respiratory power, due to elevation, is accompanied with improved alimentation and capillary circulation. More perfect elimination follows improved digestion, and life, while it may be more *rapid*, becomes more *perfect* for all who have taints of constitution to battle with. Especially for the young with tubercular and serofulous tendencies, is an active outdoor life on the plains to be recommended.

## BRONCHITIS.

Acute bronchitis is not especially frequent or severe. One is not very likely to take "cold" in an atmosphere as uniformly dry as this. Yet, sometimes during cold weather there is liable to be a short season, when influenza and "colds" are quite general.

Capillary bronchitis, especially in children, is, I believe, aggravated by high altitudes. This would be expected from the increased labor required of the lungs.

I hardly know what to write of chronic bronchitis, having become suspicious from often finding it simply a symptom of further lung trouble, which had before attracted but little attention. It is much like the "catarrh" which in the States is prone to attach itself to failing constitutions. Such bronchial catarrhal conditions, or rather the depreciated states which give rise to them, are most favorably influenced by an outdoor life in this sunny climate.

## PLEURISY.

Pleurisy, associated with cough, as would be expected, is hard to bear. It is chiefly met with in those whose lungs are defective, and not often as uncomplicated. Where one is deprived of the use of a considerable portion of lung surface, and the pleura covering another portion is affected, his condition is especially unfortunate in very high altitudes.

## PNEUMONIA.

Acute uncomplicated pneumonia is not often met with compared with its frequency in damp climates.<sup>1</sup> But when it does occur, excluding some very mild cases, the influence of elevation is of an aggravating character. Unlike a slow chronic pneumonia, the lung needs *rest*, which it cannot have. The fatality of double pneumonia is especially to be feared. Pneumonia is to be dreaded in little children, in whom the fever is apt soon to run high. What is done for them must be well directed and immediate, for the reward of efficient treatment is often as surprising to the physician as the intensity of the fever. This is one of the instances where the disciple of a limited sect is wont to show his good sense in treatment by the degree to which he abandons the precepts of his *pathy*.

In claiming infrequency of pneumonia, exception must be made of a peculiar phase of the disease, which sometimes is almost epidemic in winter at great elevations.

This high altitude pneumonia shows its special and severe character, as it attacks miners who remain high up in the mountains all winter, as on Mounts Bross and Lincoln, where mines are continuously worked between 12,000 and nearly 14,000 feet above sea level; at these places some of the strongest men are taken, first with a chill—generally on coming out of the mine after a day's work, followed by great pain in the chest, expectoration of blood, and sometimes extensive hemorrhage; a dry erythematous condition of the mucous membrane lining the nasal passages, fauces, and bronchi is noted. The symptoms of pulmonary congestion rapidly supervene, and are very decided in the fatal cases, which seem to be in a ratio corresponding to the alti-

<sup>1</sup> See mortality statistics in U. S. census 1870.

tude. Improvement is generally noticed on descending to the valley. I cannot say much of the treatment, having had little experience with typical cases in Denver. I saw one case, apparently of this character, in a robust, middle-aged man, with my friend Dr. Stedman. We bled him freely, at first with marked relief of the great constriction and pain in the chest, followed by rapid resolution and recovery.

### PULMONARY HEMORRHAGE.

While hemorrhage is mainly to be considered as a symptom of commencing or seated pulmonary disease, it is well to examine what influence elevation has in the premises. Is it a frequent occurrence in Colorado? Exempting cases of phthisis with excavation in the lungs, the high altitude pneumonia already mentioned, and making some allowance for the large number of the inhabitants who have come to Colorado, because of pulmonary disease, and pulmonary hemorrhage is rare. It seems that the healthful condition of circulation, and atmospheric pressure within the lungs, acts as a preventive in some cases by relieving the hyperamia which precedes hemorrhage. At the same time it is plain that when pulmonary hemorrhage does occur, much elevation, by the increased demand on respiratory organs, would somewhat seriously complicate matters. So it is with the hemorrhage which comes from a cavity in the lungs. The stretching which this part gets is anything but remedial.

As to the hemorrhagic cases of phthisis, they are here as elsewhere the most favorable.

While I have known of invalids bleeding at Omaha and on the way to Colorado, and after their arrival being free from it, yet I believe the precaution is a good one, to avoid a sudden and great rise in elevation, after a recent pulmonary hemorrhage, especially if there is a local injury or cavity in the lungs.

A sojourn of a week at some midway station (as at Wallace, on the Kansas Pacific Railway), is advisable for some of these invalids, or, better still, if in summer, a ride across the plains in a wagon, and camping out on the way.



CHRONIC, "UNCURED," CATARRHAL, CROUPOUS, AND  
DESQUAMATIAL PNEUMONIA.

Reserving for a future occasion the report of my cases of phthisis, I will briefly state here a few points in reference to the disease. The various forms of pulmonary defects (chiefly inflammatory) which the profession are coming to consider as constituting the first stage of consumption, are particularly referred to under the above heading. This may be the place, but there is not now the time nor space, to fully discuss the differential diagnoses of the pathological states referred to. Of course, in the present transitory stage of professional opinion on this subject, there may be some confusion, and misconception of terms used; but speaking now only in a general way, I hope to make myself understood.

The character of diseases referred to are of a chronic tendency, affecting mainly the apices of the lungs, chiefly known by the local physical signs of lessened expansion, dulness, bronchial or difficult respiration, prolonged expiration, exaggerated whisper, vocal fremitus, and resonance.

Now, excluding these cases, after breaking down of lung tissue has commenced, also those complicated with heart disease, intense fever or a very rapid pulse, and I can speak almost as favorably of the curative effects of the climate of Colorado in these conditions as in asthma. They are almost as certainly benefited. It is strange that infiltrated substance and hypertrophied tissue become absorbed, and peripheral portions of lung, which were before useless, become opened again to the healthful admission of air. Yet this occurrence is verified in the experience of many residents of Colorado, however poor our explanation of the *modus operandi* may be. If the foregoing account of the effect of lessened atmospheric pressure in asthma is correct, then the same influence has great weight in the pathological conditions here cited. The apices and peripheral portions of the lungs are the special seats of this early inflammation, the hypertrophied condition of epithelium, and infiltration with epithelial debris which results.

In ordinary life, and especially in indoor sedentary occupations, the apices are the least used and most abused parts of the lungs.

Prof. Hutchinson, in his late clinical lecture on "The Inflam-

matory Origin of Phthisis," has so excellently described the mechanical effects, "the disparity in power," in the apices of the lungs, leading to inflammation of the air cells in consequence of the impaction of epithelial debris, and especially aggravated in enfeebled conditions ("the paralytic thorax" of the Germans) by the act of coughing, that I wonder he did not think of the *mechanical agent* nature furnishes in Colorado's elevated climate, to hasten absorption and a return of the enfeebled lung tissue to a heathful condition. It is noticeable that authors of standard works have heretofore generally slighted this common sense means of treating the difficulties under consideration. The respirations with increased altitude are at first *faster* and then *deeper*. The circulation, with improved alimentation, responds quickly in consonance with the increased respiratory activity. While the quicker life inaugurated carries with it a more perfect condition of waste and repair of tissue all over the body, the capillary circulation in the lungs is becoming less impeded, because the greater quantity of dry air inspired is gently crowding before it the obstructing secretion, epithelial debris, and hypertrophied tissue, which clog the alveoli and smaller bronchi. It is thus, I conceive, the maximum respiratory capacity is again restored in lungs which were starting on the road to destruction.

The unfavorable influence of serofulous tendency, heredity, old age, lack of energy to get well, etc., must be noted in counting on the certainty or uncertainty of benefit from climate, as well as from any other means. But if the patient has the *will* to fight his enemy at every point, under the advice of those who are able to serve him, he may be almost sure of great benefit by a continuously active outdoor life in a higher and lighter atmosphere, with the other advantages the eastern Rocky Mountain slope affords.

#### CHEESY PNEUMONIA AND PULMONARY TUBERCULOSIS.

Continuing to speak in a general way, we come to more serious conditions, with which the elements of uncertainty and experiment, so far as climate is concerned, have more to do than with those just considered.

These *seated* diseases of the lungs furnish less favorable prognoses everywhere.

The evidence upon which we can speak with much needed cer-

tainty, must come from carefully recorded statistics of a good number of typical cases. Such results I hope to be able to present at no far distant day.

It is now important to note that these conditions, when incipient, may be considered in nearly the same light as those which precede them in this report.

As the pathological states under consideration progress, complications are liable to be met which will lessen the chances of recovery or permanent relief. But with the exceptions already noted, the climate of Colorado, with the right kind of outdoor life, is full of promise in these conditions all the way up (down?) to the stage of "softening." When this breaking down of lung-tissue has commenced, I do not wish to take the responsibility of indiscriminately recommending the climate of the Rocky Mountain region.

After this unfortunate stage many could live more comfortably and even longer at their homes surrounded by friends, or in other climates than those of great elevation.

A cavity surrounded by diseased lung-tissue inclining to cheesy degeneration or thickly studded with tubercles, may be the cause of a rapid decline, when a high altitude is quickly reached, because of the sudden breaking down of this diseased tissue next to the cavity. Some may agree with me in preferring to run the risk of being rid of this diseased tissue, but there are milder ways to be chosen of "letting down" these unfortunates, who are so near death any way.

If physicians do take the responsibility of sending patients with cavities to Colorado, the other circumstances and conditions should be favorable, and if possible a slow rise in elevation (preferably in the warm months by teams across the plains) is to be recommended. For such there is encouragement in this fact, that many similar cases have come here, who have steadily improved, or seemed to have their lives very much prolonged.

It is to be noted here that having once gained relief in Colorado of serious lung disease, a return to one's old residence in the lowlands is a dangerous experiment unless for a short stay during a favorable season. The truth of this could be shown by many sad examples.

A prolonged or permanent residence is to be recommended. It is also to be noted, that the responsibility is great which rests



upon physicians of making an early diagnosis of the conditions which should send their patients to Colorado.

Physicians by the sea may say that the lessened atmospheric pressure gives us in Colorado an advantage, in making a physical examination of the lungs, by the more marked contrast afforded between dulness and resonance, the evidence of vomicae which were before concealed, etc. Nevertheless the responsibility rests mainly with the family physician of deciding at an early date whether or not his patient needs the change. Certain it is, most of the phthisical patients who have come to Colorado (with some exceptions, notably, to my knowledge, those coming from a few Chicago physicians) have not removed to this climate as soon as they might with much increased benefit. If physicians will generally come to discriminate more carefully as to *when* and *where* their patients shall seek the benefits of climate, then there is no doubt that the once barren plains east of the Rocky Mountains will soon "blossom as the rose," teeming with the renewed life which the dry, sunny and rarefied atmosphere affords.







